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Scientometric profile of Tripura University based on selected disciplines: A study

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Abstract

Research productivity of Tripura which is one of the North East Indian states is not measured from a point of view of Scientometrics until now. It's an untouched area of research. An attempt has been made in this study to understand and evaluate research productivity indexed in Web of Science database of selected disciplines from Tripura University as it is the only central university in the state. It is found that since beginning until 2019, 313 documents are indexed in the database from the broad research areas of Chemistry, Mathematics and Physics. The study revealed that Bhattacharjee, D is the most productive author; Bhattacharjee, D and Hussain,S have co-authored 52 (15.95%) articles and this pair stands on rank one; Bhattacharjee, D and Hussain, SA are found to have highest number of h index i.e. 12; Highest numbers of articles are published in Journal of the Indian Chemical Society. The maximum 0.16 RGR was recorded for the period 1994 to 1998 and maximum dt of 6.19 is recorded in 2014 to 2018 period.

Keywords: Scientometrics, Tripura, North East India, Annual growth rate, Doubling Time, Bibexcel, Pajek

Introduction

Application of arithmetical and statistical technique to establishment of science and its productivity analysis has led to the rise of Scientometrics. The study of Science productivity by applying bibliometric techniques can be termed as Scientometrics. The term gained popularity with founding of the journal named 'Seientometrics' in 1977. Scientometrics also includes socio-cultural aspects while measuring science. According to Pouris[1], "Scientometrics is for science what econometrics is for economics". Tripura is one of north east states of India located in the far east of the country. In this study we have attempted evaluate research performance of Tripura University with special reference to three

disciplines of Chemistry, Mathematics and Physics as previously no attempt has been made to study the research productivity of this region of the country. (A. Kumar, Prakasan, Kalyane, & Kumar, 2008)[2] performed a Scientometrics analysis on "Pramana - Journal of Physics". It was found that numbers of collaborated papers were increasing. (Sinha, 2017)[3] performed a scientometric analysis on the publication produced by Nobel Laureate Amartya Sen. It was found that he wrote 43 books both single authored and co authored and authored maximum books on topics like Social Problems and Financial Economics. (Garg & Tripathi, 2017)[4] evaluated Indian research papers published in the area of Bibliometrics and Scientometrics and one fifth papers were found to remain uncited; 15% were revealed to get more than 20 times cited; B.M. Gupta was found to be the most productive author in the area but it was S. Arunachalam who received maximum citations. (Kalita, 2017)[5] conducted a Scientometric study of one of most prestigious journals of the world: Nature. It was revealed from the study that Nature publishes maximum research articles followed by Editorial and News Item; Self citation rate of Nature was found to high and as a result it stood first in the list of journals cited by Nature followed by Science.

Scope and objectives

The objective of the study is to create a scientometric profile of selected disciplines of Tripura University. Evaluating research productivity gives clear idea about performance of an institute and this type of studies help the funders and policy makers.

Methodology

Web of Science is a powerful tool which provides data and helps researchers understanding characteristics of different disciplines. "OO= TRIPURA UNIVERSITY Refined by: RESEARCH AREAS: (CHEMISTRY OR PHYSICS OR MATHEMATICS) Time span: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI". A total of 313 records were retrieved on being used this search query. The records retrieved are analysed hence forth. For analysing data Bibexcel[6] software is used and for visualization purpose Pajek[7] software is used. The three disciplines of royal sciences are considered for this study. Formulas used in the study are,

a. Annual Growth Rate

Based on the annual growth rate (AGR) given by (Kumar and Kaliyaperumal, 2015)[8] researcher proposed AGR= {(End Value – First Value)/ First Value} * 100.

a. Relative Growth Rate and Doubling Time: The growth rates of publications have been calculated on the basis of RGR and Dt model, developed by (Mahapatra, 1985)[9].

$$\textbf{RGR} = \frac{W2-W1}{T2-T1}$$

Where, RGR=mean relative growth rate over the specific period of interval

$\text{Log}_e W_1$ = log of initial number of articles ; $\text{Log}_e W_2$ = log of final number of articles after a specific period of interval ; T2– T1= the unit difference between the final time and initial time

$$\textbf{Doubling Time} = \frac{0.693}{RGR}$$

Scientometric Analysis

Table 1 represents the ranking of authors making 15 or more than 15 contributions from the three disciplines cumulatively. For 313 documents 326 unique authors are found from the dataset. Bhattacharjee, D is found to be the most productive author 59 (18.19%) contributions followed by Hussain,S with 57 (17.48%) and Dinda B holds the third rank with 45(13.80%).

Table1: Ranking of authors

Sl. No.	Rank	Name	Contributions	Percentage
1	1	Bhattacharjee D	59	18.10
2	2	Hussain S	57	17.48
3	3	Dinda B	45	13.80
4	4	Lal R	38	11.66
5	5	Nath R	29	8.90
6	6	Kumar A	28	8.59
7	6	Singh M	28	8.59
8	7	Harigaya Y	20	6.13
9	8	Chowdhury S	19	5.83
10	9	Majumdar S	18	5.52
11	9	Das A	18	5.52
12	9	Chakraborty A	18	5.52
13	10	Adhikari S	17	5.21
14	11	Debnath S	16	4.91
15	11	Maiti D	16	4.91
16	12	Dey D	15	4.60
17	12	Chattopadhyaya S	15	4.60

Based on the top contributing authors who produced 15 or more than 15 documents showed in table 1, pair of authors is ranked in Table 2 and it shows Bhattacharjee, D and Hussain,S have co-authored 52 (15.95%) articles and this pair stands one rank one.

Table 2: Ranking of collaborating pairs

Sl. No	Rank	Authors		Number of concurrences	Percentage
1	1	Bhattacharjee D	Hussain S	52	15.95
2	2	Kumar A	Lal R	26	7.98
3	3	Dinda B	Harigaya Y	20	6.13
4	4	Das A	Singh M	13	3.99
5	5	Maiti D	Majumdar S	13	3.99
6	5	Dey D	Hussain S	12	3.68
7	6	Bhattacharjee D	Dey D	12	3.68
8	6	Adhikari S	Lal R	11	3.37
9	7	Debnath S	Dinda B	11	3.37
10	7	Lal R	Singh M	11	3.37
11	8	Debnath S	Harigaya Y	9	2.76
12	9	Chakraborty A	Majumdar S	7	2.15
13	9	Chakraborty A	Maiti D	7	2.15
14	9	Adhikari S	Singh M	7	2.15
15	10	Adhikari S	Kumar A	6	1.84
16	11	Adhikari S	Das A	5	1.53
17	12	Chowdhury S	Maiti D	4	1.23
18	13	Debnath S	Maiti D	3	0.92
19	13	Debnath S	Majumdar S	3	0.92
20	13	Chakraborty A	Nath R	3	0.92
21	14	Kumar A	Singh M	2	0.61
22	14	Kumar A	Nath R	2	0.61
23	14	Hussain S	Majumdar S	2	0.61
24	14	Hussain S	Nath R	2	0.61
25	14	Bhattacharjee D	Nath R	2	0.61
26	14	Chowdhury S	Majumdar S	2	0.61
27	14	Das A	Dinda B	2	0.61
28	14	Chakraborty A	Debnath S	2	0.61
29	15	Majumdar S	Nath R	1	0.31
30	15	Maiti D	Nath R	1	0.31
31	15	Bhattacharjee D	Majumdar S	1	0.31
32	15	Lal R	Nath R	1	0.31
33	15	Das A	Debnath S	1	0.31
34	15	Hussain S	Maiti D	1	0.31
36	15	Chowdhury S	Dinda B	1	0.31
37	15	Chowdhury S	Nath R	1	0.31

Co authorship network

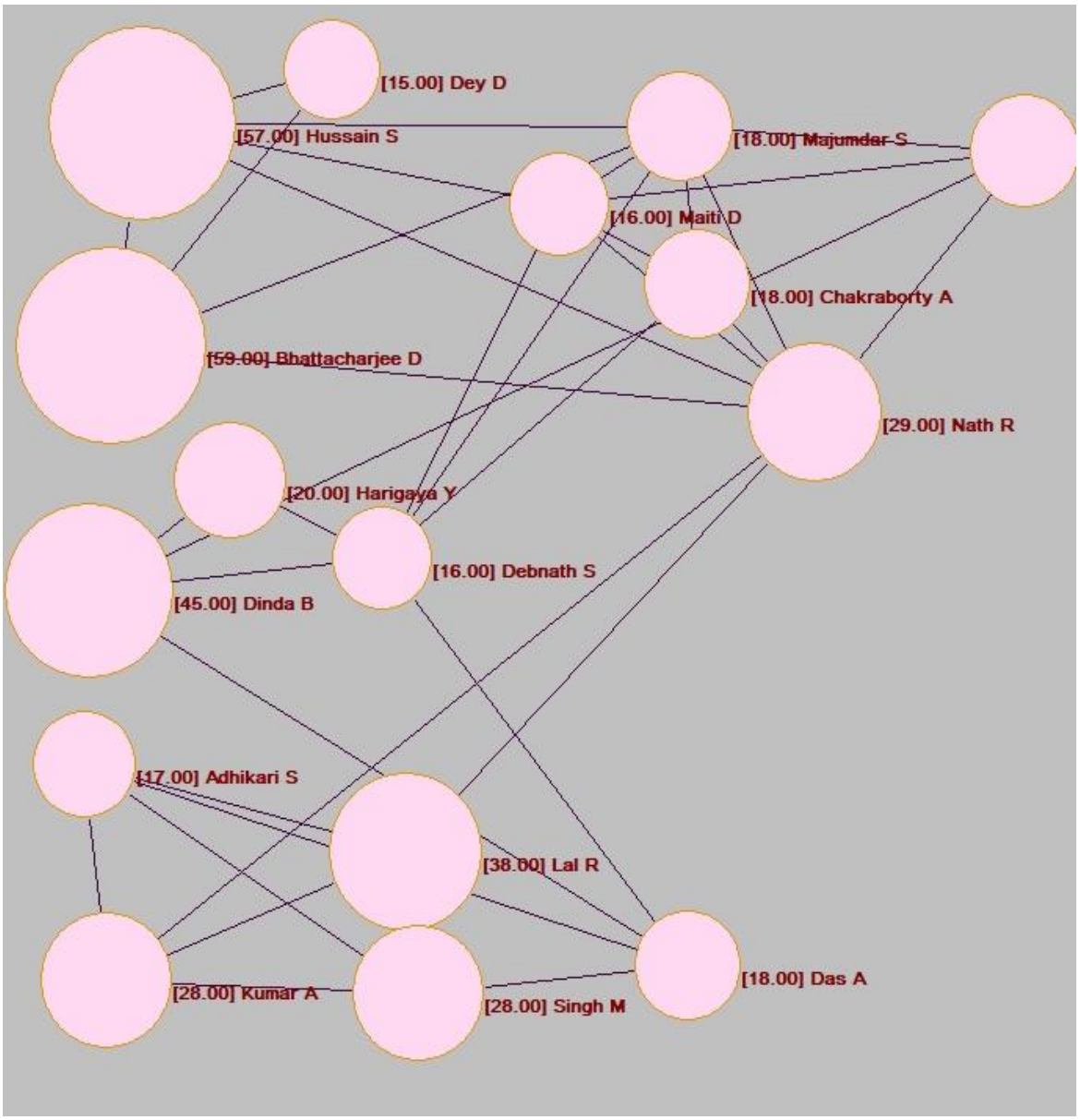

Figure 1: Co authorship network of top 17 authors making 15 or more than 15 contributions

The co authorship network of authors is visualized in figure 1. In the figure, the size of each author node symbolizes number of articles written by particular author and edges denote article/s written by authors as a result of collaboration. The figure is created using Pajek visualisation software.

H INDEX

H index is an author level metric. It is used to evaluate author performance. It can also be used to measure performance of countries and organizations. Index of h for an author means h number of his/her paper got minimum h number of citations each paper.

In table 3, H index is shown for the authors whose index value is 5 or more than 5. Bhattacharjee, D and Hussain, SA are found to have highest number of h index i.e. 12.

Table 3: H index of authors

Sl. No.	Author	h-index	Citation sum within h-core	All citations	All articles
1	Bhattacharjee, D	12	226	394	59
2	Hussain, SA	12	238	377	57
3	Dinda, B	10	534	633	45
4	LAL, RA	10	152	276	38
5	Dey, D	9	151	157	15
6	Singh, MK	9	100	163	28
7	Kumar, A	9	125	187	28
8	Chakraborty, S	8	143	155	13
9	Debnath, S	7	418	437	16
10	Chakraborty, AK	7	109	120	9

Ranking of Subject headings

Subject headings based on their frequency of occurrences are ranked in table 4.

Table 4: Ranking of Subject headings

Sl. No.	Rank	Keywords	Occurrences	Percentage
1	1	Ligands	22	4.39
2	2	Derivatives	20	3.99
3	2	Monolayers	20	3.99
4	2	Acid	20	3.99
5	3	Behavior	13	2.59
6	4	Crystal-Structure	12	2.40
7	4	Nanoparticles	12	2.40
8	4	Chemistry	12	2.40
9	4	Fluorescence	12	2.40
10	4	Spectra	12	2.40
11	5	Air-Water-Interface	11	2.20
12	5	Molecules	11	2.20
13	5	Optical-Properties	11	2.20
14	5	Oxidation	11	2.20
15	6	Thin-Films	10	2.00

16	6	Copper(Ii)	10	2.00
17	6	Metal-Complexes	10	2.00
18	6	Coordination	10	2.00
19	6	Nickel(Ii)	10	2.00
20	6	Langmuir-Blodgett-Films	10	2.00

A total of 501 subject headings were retrieved for the dataset. Out of which the term Ligands occurred highest number of times with a frequency of 22 (4.39%) times. In the table only those keywords are mentioned which occurred more than 10 times to avoid the bulkiness of the thesis.

Cluster analysis

Based on the top ranked subject headings shown in table 4, cluster analysis performed on the subject headings and it is displayed in table 5 and figure 2. It is found that the pair Monolayers and Behavior and Air-Water-Interface and Monolayers occurred 5 times together each which is highest number of times that two keywords are occurring together.

Table 5: Cluster analysis

Sl. No.	Pair of subject headings		Frequency
1	Monolayers	Behavior	5
2	Air-Water-Interface	Monolayers	5
3	Metal-Complexes	Ligands	4
4	Crystal-Structure	Ligands	3
5	Ligands	Acid	3
6	Coordination	Oxidation	3
7	Coordination	Chemistry	3
8	Crystal-Structure	Copper(Ii)	3
9	Copper(Ii)	Nickel(Ii)	3
10	Nanoparticles	Behavior	3
11	Fluorescence	Behavior	3
12	Fluorescence	Molecules	4
13	Fluorescence	Derivatives	3
14	Thin-Films	Fluorescence	2
15	Langmuir-Blodgett-Films	Molecules	2
16	Langmuir-Blodgett-Films	Spectra	2
17	Optical-Properties	Acid	1
18	Copper(Ii)	Oxidation	2
19	Acid	Derivatives	2

20	Chemistry	Behavior	1

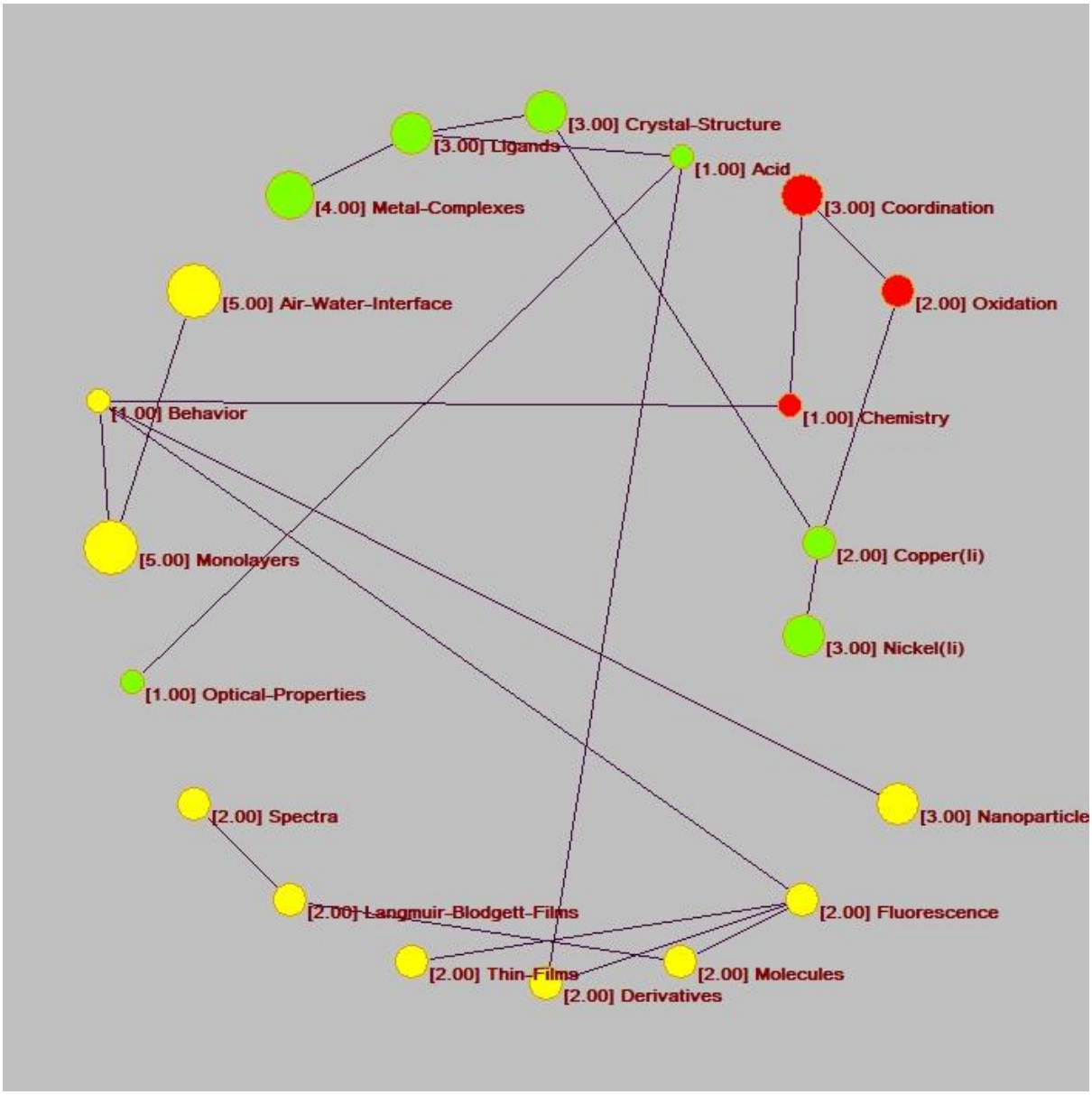

Figure 2 Cluster analyses of subject headings

Metal-Complexes and Ligands occur 4 times together. These pairs are visualized in figure 2 and the size of nodes denotes the number papers and lines denote number of co occurrences. The figure is created using Pajek.

Journals of published articles

The journals in which the researchers published their articles are displayed in table 6.

Table 6: Journals of published articles wise distribution

Sl. No.	Journal	Frequency	Percentage

1	Journal of the Indian Chemical Society	27	8.63
2	Indian Journal Of Chemistry Section A-Inorganic Bio-Inorganic Physical Theoretical & Analytical Chemistry	17	5.43
3	Indian Journal Of Chemistry Section B-Organic Chemistry Including Medicinal Chemistry	16	5.11
4	Journal Of Coordination Chemistry	16	5.11
5	Chemical Physics Letters	13	4.15
6	Fuzzy Sets And Systems	10	3.19
7	Indian Journal Of Physics	10	3.19
Total	**97 journals**	**313**	**100.00**

It is found that highest 27 (8.63%) numbers of articles are published in Journal of the Indian Chemical Society. A total of 313 articles published 97 journals. It was also found that 1 article each was published in 49 unique journals.

Chronological distribution of citations in Web of Science

The chronological distribution of web of science indexed articles produced by the researchers from the three disciplines from Tripura University is reported in table 7. It proves that 313 articles are produced during last 31 years. It is revealed that highest number of articles published in 2017 with a contribution of 32 (10.22%) articles. It also proves that 51% of total contributions were made during 2013 to 2019.

Table 7: Chronological distribution of citations in Web of Science

Sl. No.	Year	Frequency	Percentage	Cumulative Percentage
1	1989	2	0.64	0.64
2	1990	2	0.64	1.28
3	1991	1	0.32	1.60
4	1992	6	1.92	3.51
5	1993	8	2.56	6.07
6	1994	1	0.32	6.39
7	1995	4	1.28	7.67
8	1996	4	1.28	8.95
9	1997	7	2.24	11.18
10	1998	7	2.24	13.42
11	1999	6	1.92	15.34
12	2000	2	0.64	15.97
13	2001	6	1.92	17.89
14	2002	9	2.88	20.77
15	2003	6	1.92	22.68

16	2004	4	1.28	23.96
17	2005	7	2.24	26.20
18	2006	14	4.47	30.67
19	2007	11	3.51	34.19
20	2008	9	2.88	37.06
21	2009	10	3.19	40.26
22	2010	10	3.19	43.45
23	2011	15	4.79	48.24
24	2012	8	2.56	50.80
25	2013	14	4.47	55.27
26	2014	21	6.71	61.98
27	2015	24	7.67	69.65
28	2016	26	8.31	77.96
29	2017	32	10.22	88.18
30	2018	27	8.63	96.81
31	2019	10	3.19	100.00
	31 years	**10**	**100.00**	

Growth Rate of Publications in WoS

To find out annual growth rate, formula “a” is used. The maximum 500.00 AGR is recorded in the year 1992 followed by 300.00 AGR in the year 1995 and 200.00 AGR in the year 2001.

Table 8 Annual Growth Rate of Publications in WoS

Sl.No.	Year	Number of publication	AGR
1	1989	2	0
2	1990	2	0
3	1991	1	-50.00
4	1992	6	500.00
5	1993	8	33.33
6	1994	1	-87.50
7	1995	4	300.00
8	1996	4	0.00
9	1997	7	75.00
10	1998	7	0.00
11	1999	6	-14.29
12	2000	2	-66.67
13	2001	6	200.00
14	2002	9	50.00

15	2003	6	-33.33
16	2004	4	-33.33
17	2005	7	75.00
18	2006	14	100.00
19	2007	11	-21.43
20	2008	9	-18.18
21	2009	10	11.11
22	2010	10	0.00
23	2011	15	50.00
24	2012	8	-46.67
25	2013	14	75.00
26	2014	21	50.00
27	2015	24	14.29
28	2016	26	8.33
29	2017	32	23.08
30	2018	27	-15.63

*Year 2019 is not considered

It is seen from table 8 that for the years 2008, 2013, 2015 and 2016 AGRs are recorded in negative as -75, -50.00, -21.43, -9.09 respectively.

Relative growth rate and doubling time: Table 9 corresponds to the relative growth rate and doubling time of publications in Web of Science the discipline of Chemistry, Physics and Mathematics for the duration of 1989 to 2018. The data is analysed in five years blocks to get better understanding.

RGR is calculated to evaluate the increase in the number of research productivity on time and the Dt is directly associated with RGR. To find out the relative growth rate and doubling time, formula explained in equation “b” is used.

Table 9: Relative growth rate and doubling time of Publications in WoS

Sl.No.	Year	Number of publication	Cumulative no. of publications	W1	W2	RGR	Dt
1	1989 to 1993	19	19	0	2.94	0	0
2	1994 to 1998	23	42	2.94	3.74	0.16	4.33
3	1999 to 2003	29	71	3.74	4.26	0.10	6.66
4	2004 to2008	45	116	4.26	4.75	0.10	7.07
5	2009 to 2013	57	173	4.75	5.15	0.08	8.66
6	2014 to 2018	130	303	5.15	5.71	0.11	6.19

The maximum 0.16 RGR was recorded for the period 1994 to 1998, followed by 0.11 RGR was recorded for the period 2014 to 2018 and 0.10 RGR was recorded for the periods 1999 to 2003 and 2004 to2008. The minimum 0.08 RGR is recorded for the period 2009 to 2013.

From the formula b, it is defined that there is a direct equivalence existing between the RGR and Dt. If the amount of publications of a topic doubles, during the period of study, then the difference between the logarithm of the numbers at the initial and at the end of the period must be the logarithms of the number 2. When natural logarithm is applied, this difference has a rate of 0.693 (Beaie and Acol, 2009)[10].

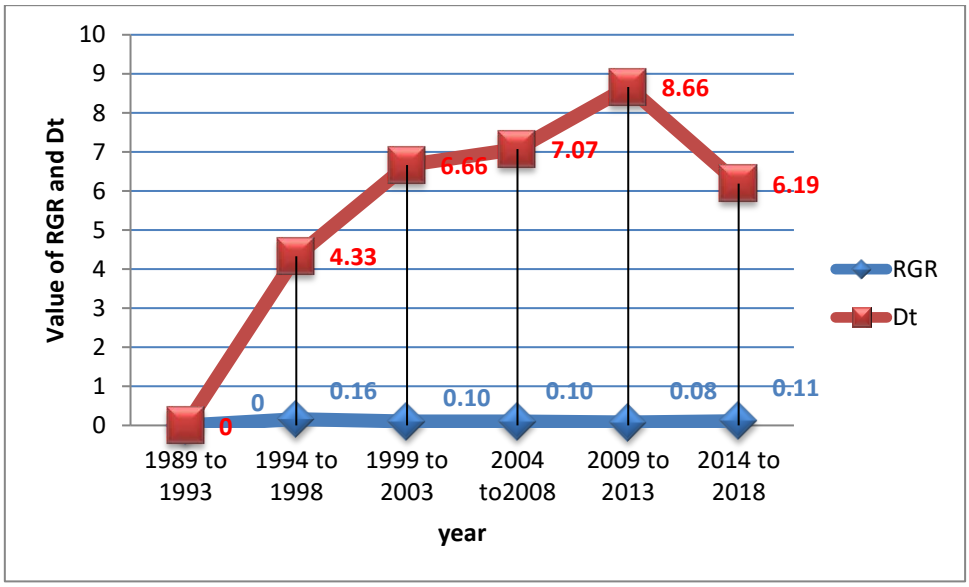

Figure 3: Relative growth rate and doubling time of Publications in WoS

From figure 3 and table 9, it is evident that the maximum 8.66 doubling time was recorded in 2009 to 2013 followed by 7.07 doubling time during 2004 to 2008 and 6.66 during 1999 to 2003. The minimum doubling time of 4.33 is noticed during 1994 to 1998.

The values of RGR gradually decreased from top to bottom over the years. The values of Dt are increasing from top to bottom with. It shows the rate is low in terms of proportion, and this has been highlighted by doubling time for publications, which is more than the relative growth rate.

Conclusion

The current is an approach to find research productivity insight about the less ventured region of North East India especially Tripura. It was found that a total 313 documents from the three

disciplines are indexed in Web of Science from Tripura University. The study is performed based on this dataset and found that Bhattacharjee, D is the most productive author; Bhattacharjee, D and Hussain,S have co-authored 52 (15.95%) articles and this pair stands on rank one; Bhattacharjee, D and Hussain, SA are found to have highest number of h index i.e. 12; Highest numbers of articles are published in Journal of the Indian Chemical Society. (Verma and Shukla, 2019)[11] mapped information literacy research and found maximum RGR 0.795 and Dt. 5.824 were reported in 2009 and 2017. The maximum 0.16 RGR was recorded for the period 1994 to 1998 and maximum dt of 6.19 is recorded in 2014 to 2018 period. The values of Dt are increasing from top to bottom with. It shows the rate is low in terms of proportion, and this has been highlighted by doubling time for publications, which is more than the relative growth rate.

References

1. Pouris, A. Scientometric assessment of agricultural research in South Africa. *Scientometrics*, 1989, 17(5-6), 401-413. *https://link.springer.com/article/10.1007/BF02017461* (accessed on 25 May, 2019)
2. Kumar, A., Prakasan, E. R., Kalyane, V. L., & Kumar, V. Pramana - Journal of Physics : A scientometric analysis. *Annals of Library and Information Studie*, 2008, 55(1), 202-211. https://pdfs.semanticscholar.org/49af/6914baa8ec1e76917813c1f6779e66fb725d.pdf (accessed on 25 May, 2019)
3. Sinha, A. K. (2017). Scientometric study of books authored by nobel laureate amartya sen. *Annals of Library and Information Studies*, *64*(1), 9–15. *nopr.niscair.res.in/bitstream/123456789/41539/1/ALIS%2064%281%29%209-15.pdf* (accessed on 2 June, 2019)
4. Garg, K. C., & Tripathi, H. K. (2017). Bibliometrics and scientometrics in India : An overview of studies during 1995-2014 Part I : Indian publication output and its citation impact. *Annals of Libary and Information Studies*, *64*(March), 28–36. http://nopr.niscair.res.in/bitstream/123456789/41534/1/ALIS%2064%281%29%2028-36.pdf (accessed on 2 June, 2019)
5. Kalita, D. (2017). The Scientometrics of Nature. *Journal of Scientometric Research*, *5*(2), 123–134. https://doi.org/10.5530/jscires.5.2.3. (accessed on 2 June, 2019)
6. Persson, O., R. Danell, J. Wiborg Schneider. How to use Bibexcel for various types of bibliometric analysis. In Celebrating scholarly communication studies: A Festschrift for Olle Persson at his 60th Birthday, ed. F. Åström, R. Danell, B. Larsen, J.

Schneider, 2009, 9–24. Leuven, Belgium: International Society for Scientometrics and Informetrics. (accessed on 2 June, 2019)

7. http://mrvar.fdv.uni-lj.si/pajek/ (accessed on 2 June, 2019)

8. Kumar, R.S. & Kaliyaperumal, K. A scientometric analysis of mobile technology publications. *Scientometrics Int. J. Quant. Aspects Sci. Sci., Commun. Sci. Sci. Policy*, 2015, **105**(2), 921-939. https://www.academia.edu/33586637/A_scientometric_analysis_of_mobile_technology_publications (accessed on 2 June, 2019)
9. Mahapatra, M. On the validity of the theory of exponential growth of scientific literature. *In* Proceedings of the 15th IASLIC Conference, Bangalore,1985, 61-70.
10. Beaie, S.T. & Acol, P. Population and demographic measures: Concepts and definitions for basic MDG indicators. Kingston Georgetown, Guyana: Bureau of Statistics. 2009. file:///C:/Users/welcome/Desktop/ Concepts_and_Definitions.pdf (accessed on 12 June, 2019)

11. Verma, M. K., & Shukla, R. Mapping the Research Trends on Information Literacy of Selected Countries during 2008-2017: A Scientometric Analysis. *DESIDOC Journal of Library & Information Technology*, 2019, 39 (3): 125-130, DOI : 10.14429/djlit.39.3.14007 (accessed on 12 June, 2019)